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TRANSMITTAL SLIP			
TO: Dr. Roberts		REF. NO. OR ROOM, BLDG.	
FROM: Dr. Davis/Anita		REF. NO. OR ROOM, BLDG.	
ACTION			
<input type="checkbox"/> NOTE AND FILE		<input type="checkbox"/> PER OUR CONVERSATION	
<input type="checkbox"/> NOTE AND RETURN TO ME		<input type="checkbox"/> PER YOUR REQUEST	
<input type="checkbox"/> RETURN WITH MORE DETAILS		<input type="checkbox"/> FOR YOUR APPROVAL	
<input type="checkbox"/> NOTE AND SEE ME ABOUT THIS		<input checked="" type="checkbox"/> FOR YOUR INFORMATION	
<input type="checkbox"/> PLEASE ANSWER		<input type="checkbox"/> FOR YOUR COMMENTS	
<input type="checkbox"/> PREPARE REPLY FOR MY SIGNATURE		<input type="checkbox"/> SIGNATURE	
<input type="checkbox"/> TAKE APPROPRIATE ACTION		<input type="checkbox"/> INVESTIGATE AND REPORT	
COMMENTS: The attached report was dictated but not read by Dr. Davis.			

COMMENTS AND RECOMMENDATIONS CONCERNING THE

ARPA NETWORK

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Computer networking or teleprocessing is one of the most radical innovations in the utilization of computers in the last decade. It provides an opportunity heretofore unavailable for the sharing of computer hardware, computer software, and data files. The ARPA network is one of the most ambitious projects sponsored by the Federal government to achieve some subsets of the objectives of computer networking. It has been sponsored by ARPA of DOD with developmental costs of roughly \$10 million since 1969. Its success would provide guidelines of considerable utility to other Federal agencies interested in sharing the type of resources made available by the ARPA network. Its success would also yield guidelines that would impact on the development of similar systems by other Federal agencies. It is the role of the Center for Computer Sciences and Technology to provide adequate technical input to OST, OMB, and the other central agencies of the Federal government regarding the proper utilization and proper development of computers and their related software and systems projects.

It was in this context that I felt it urgent to make recommendations concerning the future role of the Federal government relative to the ARPA network. The comments and recommendations in the following paragraphs are informal and are meant for guidance of the addressees. I do not intend in any way to reflect upon the management or the continuing role of ARPA with respect to the ARPA network. On the contrary, ARPA is to be congratulated for a superb technical achievement in the ARPA network as it now exists.

Because of the urgency that I felt resided in presenting alternatives and recommendations regarding the role of the ARPA network in the Federal government, I was very pleased when Dr. Michael Noll of OST agreed to sponsor a meeting of a very few people who were uniquely or especially concerned with the ARPA network. This meeting was held on September 17, 1971. The attendees at this meeting were Dr. Larry Roberts, ARPA; Dr. John Pasta, NSF; Dr. Ruth Davis, NBS; Dr. Michael Noll, who chaired the meeting; and Dr. Edward David, who joined the group in time to hear its summary comments. I prepared a set of questions to which I felt answers were important and upon which the future role of the ARPA network could be more readily determined. These questions are attached for information purposes. I should like to address some selected aspects of

the answers to these questions which bear upon the possible alternatives for the ARPA network in the near term future.

First of all, the question of the developmental nature of the ARPA network is important. When the ARPA network is considered operational, then its operation and management would not properly belong to a developmental organization such as ARPA, but would be more appropriately transferred to a manager who would simply provide the services and operate the network for its groups of customers. Dr. Roberts did tell us that he considered the ARPA network as it now exists to be operational. This is the 50 kilobit message switching communications network with the interface message processors (IMP's). On this assumption, the network should be transferred for management and operational purposes to an agency other than ARPA or to a non-Federal operator or manager. This transfer should be done as rapidly as possible to permit ARPA to utilize its resources for purely developmental work or for extending the developmental work in networks to areas other than that of the existing ARPA network.

Another very relevant question is just what are the assets or the components of the ARPA network as it now exists. This question is relevant to determining just what it is one sells or transfers when one performs those actions with respect to

the ARPA network. It would appear that the ARPA network, as a salable property, consists of approximately \$1.5 million worth of interface message processor (IMP's) computers and a 50 kilobit message switching transmission system leased from AT&T at approximately a \$1 million annual cost. The IMP's are now resident at some 20 sites where they have either been procured by ARPA or bought by the resident facilities. The 50 kilobit transmission network principally interconnects universities with a few other governmental and/or laboratory facilities determined by ARPA. The buyer or receiver of the ARPA network, in addition to these assets, would have an obligation to ARPA as stated by Dr. Roberts to support the continuing developmental work that ARPA wishes to pursue utilizing the network in its existing nodes. ARPA would prefer to be given favored treatment by the buyer or recipient of the ARPA network in terms of costs of transmission as well as use of computers now resident at sites selected by ARPA where these computers have been procured by ARPA. The legality of this kind of requirement by ARPA requires some investigation if the recipient or buyer of the ARPA network is a special carrier, a common carrier, or some private enterprise.

Dr. Roberts stated that the ARPA project, resulting in the ARPA network, had as its objectives the development of this

message switching transmission system as well as the development and the sharing of computer hardware, software, and data base resources. The somewhat artificial quality of the ARPA network as a resource available to customers is due to the location of the computer resources interconnected by the ARPA network. These resources are generally located at universities not under the control of ARPA or other agencies of the Federal government where very little protocol, conventions, or procedures have been developed to permit the use of the resources, be they equipment, software, or data files, by members of the ARPA network. As a result, it would appear that the salable aspects of the ARPA network as it now exists are indeed just the IMP's and the 50 kilobit transmission system, the two together comprising a message switching transmission system between 20 or 25 fixed locations in the United States.

There are several alternatives which should immediately be considered with regard to the proper utilization or transfer of the resources and the assets of the ARPA network. I should like to list these first with a few recommendations following.

ALTERNATIVE #1: ARPA would continue operating and managing the ARPA network as an integral part of its continuing developmental work in network design and computer utilization. The network would be available only on an operational basis to

selected users who would pay ARPA for this use. All use of the network would be experimental, and customers would be told not to rely on it for any operational or required functions.

ALTERNATIVE #2: GSA would, under its Brooks Bill authorization to operate computer sharing exchanges, operate the ARPA network for the Federal customers and their contractors as deemed appropriate by GSA and OMB. GSA could delegate this responsibility, if they saw fit, to another Federal agency more interested in and/or more competent in managing such a message switching transmission system. Examples of such agencies could be NASA, AEC, or DCA. The IMP's now existing could be transferred as needed to Federal users or contractors. The additional IMP's could be procured, and the ARPA network could serve the purposes of the Federal government for a 50 kilobit message switching transmission network. This would then be a dedicated network and not in competition with common carrier services.

ALTERNATIVE #3: A private company could buy the ARPA network and operate it as a specialized data carrier. Dr. Roberts had indicated in discussions with BB&N that there had been an interest indicated in buying the ARPA network, setting up a wholly-owned subsidiary, and operating the ARPA network as a specialized carrier. BB&N is a technically-

rooted company. It has not had any experience in specialized carrier activities. There are a number of requirements, restrictions, and/or constraints which would be imposed and would have to be followed by BB&N in setting up such a wholly-owned subsidiary. The customers then could be anyone including the Federal government. The system would be in competition with common carriers and other specialized carriers such as DATRAN and MCI. The network, as such, would simply be another resource or another carrier for possible use by Federal agencies. The possibilities of ARPA being a favored customer for such an arrangement would have to be investigated.

ALTERNATIVE #4: A special interest, public-oriented community could procure the assets of the ARPA network and operate it for the benefit of its own constituencies and others as allowed by the FCC and the legal conditions imposed on communications services. Examples here would be the American Medical Association, who could operate it for the medical community; the Health Services and Mental Health Administration of the DHEW, who could operate it for the health care delivery system community; EDUCOM, who could operate it for the educational community; and the National Science Foundation and its Office of Science and Information Services, who could operate it for the scientific and technical information

community. In all such cases, customers within the Federal, state, and local governments could be provided services, and the network could be augmented or extended to encompass or cover the community of interests which now possess the ARPA network. It would be in this instance a dedicated network and subject to the proper provisions of such communications services.

ALTERNATIVE #5: A common carrier such as AT&T could buy the assets of the ARPA network and operate it as an extension of its existing services. There are no commercially available message switching transmission systems of this type, and this could indeed be an attractive asset to be procured by a common carrier. It would simply be another service available to the Federal government at the appropriate costs with no favored treatment probably to any Federal agency including ARPA.

I would recommend that immediate attention be given to the two alternatives of having GSA operate the network or having a special interest public service-oriented community buy and use the network for its own purposes on a dedicated basis. In considering any of the alternatives, more detailed information as to the true value of the assets, the true nature of the assets, the constraints or requirements of ARPA on the network in the future, the impact on other Federal network developments of this type of selling or transferring the ARPA network, and

the impact on the sharing of computer resources by Federal agencies needs to be provided before any alternative can be singled out as being of the most benefit to the Federal government. I feel it imperative that the ARPA network in concept, in practice, and in operation not be lost with respect to realizable benefits to the Federal government which sponsored it at a fairly sizable investment and to the Federal customers, who deserve the benefits of this research and development project.

Finally, I would recommend that a small committee consisting perhaps of the individuals identified in the first paragraph of this report and some legal counsel meet to determine a concerted Federal position and a concerted Federal recommendation with respect to the ARPA network.

Dictated but not read.

POLICY QUESTIONS RELATING TO THE
FEDERAL GOVERNMENT ROLE RELATIVE TO THE
ARPA NETWORK

- 1) Should the network of communications (50 kilobit services) obtained on an experimental basis for the ARPA net largely through full-time DOD leases be continued. . . . If so, for how long into the future?
- 2) On the assumption that the message switching communications concept being demonstrated by the ARPA network functions effectively to demonstrate this communication technique as an effective technique for intercomputer teleprocessing, to what extent do Federal agencies require access to the data banks and unique computer resources located within the nodes of the experimental ARPA network?
- 3) Assuming that the ARPA network clearly demonstrates the utility of the message switched communications services for intercomputer teleprocessing, to what extent should the Federal government encourage the incorporation of this kind of communication service as a service offering to be made available by the common carriers? . . . Should such communications services fall to the domain of specialized carriers?
- 4) Given that the ARPA network is experimental in nature, to what extent should Federal agencies rely upon the network in the conduct of their agency business or in the furtherance of their mission? . . . To what point and in what way does the network change from experimental to operational?
- 5) Assuming that the resources accessible through the ARPA network provide significant enhancement to the conduct of Federal agency operational business or mission accomplishment, and that the Federal agencies would wish to continue and extend the use of such resources, can the

specialized communications facilities (TIPS), etc., properly continue to be operated outside of the common carrier or specialized carrier domains? . . . If so, would this not be a "defacto" creation of another specialized carrier facility?

- 6) Should there be any restrictions upon who can have access to the ARPA network? . . . Should additional university complexes be encouraged to use it? . . . Should Federal agencies be encouraged to use it? . . . Should use be restricted to particular kinds of activity?
- 7) Assuming that it is determined that an operational network based upon the ARPA experimental network should continue into the future, what actions will be required to assure that participants in the experimental activity such as BBN, do not have a preferred position towards providing the operational facilities?
- 8) How long into the future should the Federal government continue funding support to universities with respect to operation with the ARPA network?